TOOTHBRUSH

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority, under 35 U.S.C. 119, of U.S. provisional patent application Serial No. 60/261,515 entitled "Toothbrush with Motor Integrated with Vibrating Head," filed January 12, 2001, the disclosure of which is hereby incorporated by reference in its entirety.

FIELD OF THE INVENTION

This invention relates to a powered toothbrush, and more specifically relates to a powered toothbrush having a vibrating toothbrush head isolated from the main handle.

BACKGROUND OF THE INVENTION

Typically, electric toothbrushes include a motor in the handle which drives a motion-creating mechanism, which in turn causes the toothbrush head to vibrate during use. The vibration of the head enhances the cleaning of one's teeth.

Often times, however, the vibration caused by the motor not only vibrates the brush head, but also vibrates the handle. Some users are annoyed by large vibrations of the handle. In addition, excessive vibration of the handle is an indication of an inefficient drive system which expends energy to drive not only the brush head but also the handle.

It is with these shortcomings in mind that embodiments of the invention have been developed.

SUMMARY OF THE INVENTION

According to one aspect of one embodiment of the invention, disclosed herein is a toothbrush which includes a handle, a brush shaft, a brush head with bristles, vibratory means for causing the brush head and the bristles to vibrate, and vibration isolation means for reducing the transfer of vibrations from the vibratory means to the handle.

In accordance with one embodiment of the present invention, a toothbrush includes a vibratory source (i.e., a motor) located in or near the brush head, and in order to reduce vibrations in the handle of a toothbrush, the portion of the toothbrush which contains the vibratory source is vibrationally isolated from the rest of the structure of the toothbrush.

In one embodiment, the brush head and brush shaft are vibrationally isolated from the handle by positioning the vibration isolation means between the vibratory means and the handle. In this embodiment, the vibratory means can be located anywhere along the brush shaft, or in the brush head.

In another embodiment, the vibratory source is located inside the brush head such that the vibratory source and brush head are vibrationally isolated from the brush shaft and the handle. Alternatively, the vibratory source is located inside the brush head such that the vibratory source and brush head are vibrationally isolated from the brush shaft and handle by locating an isolation structure at the brush shaft/handle intersection.

In addition, the brush shaft, which generally extends between the handle and the brush head, could be a flexible member which forms the vibration isolation structure between the brush head and motor from the shaft.

In one embodiment, the motor is driven by electricity supplied from a battery positioned in the handle. The battery can be replaceable or rechargeable. Wires may run from the battery through the handle, through an on/off switch, through the brush shaft, and to the location where the motor is located in order to supply the motor with electricity.

The features, utilities and advantages of the various embodiments of the invention will be apparent from the following more particular description of embodiments of the invention as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side view of a toothbrush, in accordance with one embodiment of the present invention.

Fig. 2 is a front view of the embodiment illustrated in Fig. 1, in accordance with one embodiment of the present invention.

Fig. 3 is a side section view taken along line 3-3 of Fig. 2, in accordance with one embodiment of the present invention.

Fig. 4 is an exploded view of the embodiment illustrated in Fig. 1, in accordance with one embodiment of the present invention.

Fig. 5 is a front perspective view of the handle portion of a toothbrush, in accordance with one embodiment of the present invention.

Fig. 6 is a front section view taken along line 6-6 of Fig. 13, in accordance with one embodiment of the present invention.

Fig. 7 is a side section view taken along line 7-7 of Fig. 13, in accordance with one embodiment of the present invention.

Fig. 8 is a front perspective view of the motor shaft of a toothbrush, in accordance with one embodiment of the present invention.

Fig. 9 is a top view of the motor shaft illustrated in Fig. 8, in accordance with one embodiment of the present invention.

Fig. 10 is a front view of the motor shaft illustrated in Fig. 8, in accordance with one embodiment of the present invention.

Fig. 11 is a side view of the motor shaft illustrated in Fig. 8, in accordance with one embodiment of the present invention.

Fig. 12 is a side section view taken along line 12-12 in Fig. 10, in accordance with one embodiment of the present invention.

Fig. 13 is an enlarged section view of the isolation structure in the embodiment illustrated in Fig. 3.

Fig. 14 is a side section view of a toothbrush, in accordance with one embodiment of the present invention.

Fig. 15 is a side section view of a toothbrush, in accordance with one embodiment of the present invention.

Fig. 16 is a side section view of a toothbrush, in accordance with one embodiment of the present invention.

Fig. 17 is a side section view of a toothbrush, in accordance with one embodiment of the present invention.

Fig. 18 is a side section view of a toothbrush, in accordance with one embodiment of the present invention.

Fig. 19 is a side section view of a toothbrush, in accordance with one embodiment of the present invention.

Fig. 20 is a side section view of a toothbrush, in accordance with one embodiment of the present invention.

Fig. 21 is a front perspective view of a toothbrush, in accordance with one embodiment of the present invention.

Fig. 22 is a side view of the end cap of a toothbrush, in accordance with one embodiment of the present invention.

Fig. 23 is a front perspective view of the end cap of Fig. 22, in accordance with one embodiment of the present invention.

Fig. 24 is a side view of a motor shaft cap, in accordance with one embodiment of the present invention.

Fig. 25 is a front view of a brush head cover, in accordance with one embodiment of the present invention.

Fig. 26 is a side section view taken along line 26-26 in Fig. 25.

Fig. 27 illustrates a flossing tip and head which may be used with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Disclosed herein, in one embodiment, is a toothbrush with vibratory means that cause the toothbrush head to vibrate, and a vibration isolation structure for isolating from the toothbrush handle the vibrations caused by the vibratory means.

Generally and as shown in the example of Fig. 3, an isolation structure or joint 18 is located between the vibratory means (in one example, a motor 24 located within brush shaft 12) and the handle 4. The isolation structure 18 allows the portion of the toothbrush that includes the vibratory means to move in a vibrating manner independent of the handle or portions of the toothbrush on the side of the isolation structure opposite from the vibratory means. The purpose of isolation structure 18 is to reduce, modify, minimize, or attenuate the amount of vibration felt in handle 4 caused by the vibratory means 24 vibrating in brush shaft 12 (or elsewhere), while permitting the brush shaft 12 and the bristles 16 to move or vibrate.

Referring now to Figs. 1-2, the exterior of one embodiment of a toothbrush 2 is shown. Toothbrush 2 includes a handle 4, an end cap 6 attached to one end of the

handle, and a brush shaft 12 attached to an end 8 of the handle opposite the end cap 6. A brush head 14 is attached to the end of the brush shaft 12, and bristles 16 extend outwardly from a surface of the brush head 14. Brush shaft 12 and brush head 14 may be integrally formed. The brush shaft 12 is attached to handle 4 about a motor shaft 28 (Fig. 3) connected at isolation structure 18, in one example. In the embodiment illustrated in Figs. 1-2, a slight gap or annular spacing 20 is defined around the isolation structure 18 between the brush shaft 12 and handle 4 to allow brush shaft 12 to move with respect to handle 4 in a vibratory manner.

Fig. 3 is a representational cross-sectional view of one embodiment of toothbrush 2 and shows the internal mechanisms thereof. As illustrated in Fig. 3, a battery 10 is positioned inside handle 4. The battery supplies energy to vibratory means located in the brush head via wire leads 23a,b. The base or end cap 6 is attached to an end of the handle 4 to hold the battery inside the handle. End cap 6 can be taken off handle 4 to allow the battery 10 to be replaced. End cap 6 also may act as an on/off switch to control the actuation of the motor 24.

As shown in Figs. 3-4, brush shaft 12 attaches to an opposite end 26 of handle 4 about motor shaft 28 positioned inside brush shaft 12. Bristle tufts 16 are attached to brush head 14 in a known manner.

Figs. 5-7 show handle 4 according to one embodiment of the present invention. Generally, handle 4 is hollow and cylindrically shaped with a smaller diameter top end 26 and large diameter bottom end 8, in one example. Handle 4 defines an open lower end 8 which has a slightly larger diameter than an open upper end 26. As shown in Figs. 6-7, axial recess 22 is formed within handle 4 from top end 26 to bottom end 8. Axial recess 22 is used to hold the battery 10 or other power source and acts as a conduit for the electrical wire leads which are connected between power source 10 and vibratory means 24 located elsewhere in the toothbrush.

In Fig. 6, adjacent the top end 26 of handle 4 on inside walls 54 of handle 4 are annular grooves 52 for receiving O-rings 50 (Fig. 4) positioned about a portion of motor shaft 28. As described further below, a protrusion 86 (Figs. 5-7) extends from top open end 26 of handle 4 for ensuring that motor shaft 28, brush shaft 12 and handle 4 are properly oriented together.

Referring to Figs 4, 6-7, depending on the type of end cap 6 used, the interior walls of the handle 4 adjacent the bottom end 8 may include detents or threads for

releasably securing the end cap to the bottom end of the handle. The front face of handle 4 may also include either an opening or a depressed area 90. The opening or depressed area may act as a recessed area adapted to a user's thumb , or may be configured as a control button for the device in another embodiment.

As illustrated in Figs. 3-4, the brush shaft 12 is positioned about motor shaft 28 which is connected with open upper end 26 of handle 4. The brush shaft defines a housing which may be cylindrical and includes a closed upper end and open bottom end. The upper end of the motor shaft 28 is received within the open bottom end of the brush shaft. Vibratory means 24, such as a motor, are retained within the upper end of the motor shaft 28, in one example.

More specifically, open upper end 26 of handle 4 is attached to brush shaft 12 through motor shaft 28. Isolation structure 18 is formed at the region between open top end 26 of handle 4 and bottom end 44 of motor shaft 28.

In Fig. 3, brush shaft 12 forms a housing along most of its length up to brush head 14. Towards an end 30 of brush head 14, brush shaft 12 slims down to allow for convenient manipulation of brush head 14 in the user's mouth.

Motor shaft 28 is received within brush shaft 12. Motor shaft 28 is generally long and cylindrical in shape with a cylindrical cavity or bare 42 extending from one end 44 to the other 46 (Fig. 12). As shown in Fig. 4, one end 44 of motor shaft 28 is constructed to insert into open top end 26 of handle 4 to connect motor shaft 28 which forms isolation joint 18. The other end 46 of motor shaft 28 defines a motor receiving cavity 48 for secure placement of vibratory means 24.

Figs. 8-12 show one example of motor shaft 28. Motor shaft 28 defines a top end 46 and a bottom end 44. Referring to Fig. 12, a bore 42 runs axially through top end 46 to bottom end 44. As shown in Fig. 3, the electrical wires 23a,b between the power supply 10 and motor 24 run through this axial bore 42. In Fig. 12, the bore also defines a cavity 48 for receiving vibratory means such as an eccentric motor. In at least one embodiment, the interior walls of the motor receiving cavity 48 include detents protrusions 49 for securing the motor within the cavity 48.

Bottom end 44 of motor shaft 28 is adapted to be attached to open top end 26 of handle 4. Bottom end 44 of motor shaft 28 defines axially extending fingers 60 that help engage bottom end 44 of motor shaft 28 with handle 4. As shown in Fig. 11, bottom end 44 of motor shaft 28 also defines O-ring grooves 52 for receiving O-

rings 50. A flange 56 is defined annularly around motor shaft 28. In one embodiment, flange 56 is narrowest at the top 80 and widest at the bottom 82, where it defines a key slot 84 (Figs. 8, 9,10) for receiving the protrusion 86 extending off open top end 26 of handle 4. This ensures that motor shaft 28 and handle 4 are properly oriented together. Preferably, the protrusion 86 is received in the key slot 84 but does not physically contact the interior walls of key slot 84.

As shown in Fig. 10, motor shaft 28 has a raised ridge 83, extending axially along the length of motor shaft 28. The interior wall of brush shaft 12 may have a notch, extending axially along a portion of the length of the brush shaft, to receive the raised ridge 83 of the motor shaft 28. The raised ridge and axial notch act to orient and guide brush shaft 12 into proper relative position as a user places brush shaft 12 about motor shaft 28.

Since brush shaft 12 covers motor shaft 28, and in combination is attached as described above to handle 4, by keying motor shaft 28 to handle 4 the proper orientation of toothbrush 2 with respect to handle 4 is obtained. Protrusion 86 on handle 4 extends axially from side 88 of handle 4 where a thumb depression/on-off button 90 may be formed.

As mentioned above, a flange 56 is formed on motor shaft 28 above the innermost O-ring 50. Flange 56 is contacted by bottom 33 of brush shaft 12 (see Fig. 4). Flange 56 helps keep brush shaft 12 from being pushed too far out over motor shaft 28, and also helps keep motor shaft 28 from being pushed too far into handle housing 4.

Referring to Fig. 13, motor shaft 28 is retained within the handle 4 by a snap fit structure, which in one embodiment acts as an isolation joint18. The first end 44 of motor shaft 28 defines flexible separated fingers 60 extending axially from the first end 44 of motor shaft 28. Each finger 60 defines an outwardly extending overhang 62 that extends radially outwardly from outer surface 64 of motor shaft 28 as defined between the pair of O-rings 50. Overhang 62 creates a sloped surface 65 on an outer circumferential surface 66 of first end 44 of motor shaft 28. The inside diameter of handle housing 4 is slightly smaller than the diameter measured from overhang to overhang on diametrically opposed flexible fingers 60. Thus when motor shaft 28 is inserted into handle housing 4, flexible fingers 60 are flexed inwardly to allow a portion of motor shaft 28 to pass into recess 22 in handle housing 4.

In one embodiment, the inner diameter of handle housing 4 abruptly increases to form a shoulder 68. When each of the overhangs 62 on the respective fingers 60 passes shoulder 68, the fingers 60 flex outwardly to their natural positions. If motor shaft 28 is moved in a direction to try to extract it from handle housing 4, overhang 62 on each of the flexible fingers 60 engages shoulder 68 and thus retains motor shaft 28 in handle housing 4. Overhang 62 is however not large enough to withstand any substantial force, and if a sufficient extraction force is applied to motor shaft 28, the motor shaft can be withdrawn from handle housing 4 since the extraction force could overcome the contact between overhang 62 of shoulder 68 and thus force flexible fingers 60 to flex inwardly and allow motor shaft 28 to be extracted. Nonetheless, overhang 62 and shoulder 68 do engage sufficiently to keep and retain motor shaft 28 in handle housing 4 under normal use conditions. In one embodiment, overhang 62 on each flexible finger 60 acts as a side wall for the O-ring groove 52 formed at first end 44 of motor shaft 28.

Generally, with respect to the positioning of vibratory means 24 in toothbrush 2, in one embodiment vibratory means 24 is positioned close to brush head 14, and possibly even in brush head 14, to maximize the effect of the vibratory means's vibrating motion. As shown in Fig. 3, when the brush shaft 12 is positioned about motor shaft 28, the vibrating vibratory means 24 is positioned within brush shaft 12 adjacent brush head 14. In one example, vibratory means 24 is positioned adjacent brush head 14, and not in brush head 14, so that there is sufficient room in brush head 14 to position bristle tufts 16, as well as needing to have a slim shaped brush head 14 for accessibility in one's mouth. However, as smaller vibratory means become available, its contemplated that vibratory means 24 could be positioned inside brush head 14 to efficiently drive brush head 14 as described herein. For example, a piezo-electric type of vibration motor may be positioned in brush head 14.

In one embodiment, vibratory means 24 includes an eccentric motor which rotates an off center weight attached thereto. One motor which may be used for creating the vibration is a Jinglong Co. model OTL-6CL or equivalent. The OTL-6CL model is generally a 1.3V DC motor. However, any motor suitable for creating vibration that has a small enough size and can be powered by a battery the size of an AA battery or the like could be used. Off-center weight motor 24 provides a

magnitude of tip motion (approximately 0.02 inches in the x and y directions) for brushing purposes, in one example.

In one embodiment, the vibrations generated by the vibratory means selected may cause the brush head to vibrate in a substantially orbital motion. However, in other embodiments, the vibrations generated by the vibratory means selected may cause the brush head to vibrate in any type of motion suitable for cleaning teeth including axial, horizontal, vertical, diagonal, and circular motions.

As illustrated in Fig. 4, in one embodiment, the isolation joint structure 18 is formed at the connection point of the motor shaft end and the top open end of the handle. The bottom end 44 of the motor shaft 28 is received within the top open end 26 of the handle 4 to form the isolation joint structure 18, in one embodiment. The isolation joint structure 18 illustrated in Fig. 13 includes a pair of O-rings 50 positioned at end 44 of motor shaft 28 and received inside open top end 26 of handle 4. O-rings 50 are resilient and flexible, and thus allow motor shaft 28 (and thus brush shaft 12) to move under the influence of vibratory means in a relatively isolated manner, such motion being relatively independent of handle 4. The amount brush shaft 12 moves separately from handle 4 depends on the resiliency and dampening characteristics of isolation joint structure 18. In one embodiment of the present invention, isolation joint structure 18 includes an O-ring 50 positioned within annular grove 52 of motor shaft 28, a second O-ring 50 positioned within a second annular groove 52 spaced away from the first O-ring 50. The O-ring annular grooves 52 are formed in the wall 54 of handle housing 4 to respectively receive the O-rings 50 on end 44 of motor shaft 28. The end 44 of motor shaft 28 having the O-rings 50 is inserted into handle housing 4, and the O-rings 50 are located in their respective grooves 52.

In Fig. 13, first end 44 of motor shaft 28 is shown received in top end 26 of handle housing 4. Again, isolation joint structure 18 is formed by the engagement of the O-rings 50 positioned on first end 44 of motor shaft 28 in the O-ring channels 52 formed in inner wall 54 of handle housing 4. In one embodiment, motor shaft 28 does not physically contact directly handle housing 4, and is spaced away from handle housing 4 by the O-rings 50. The isolation joint structurally isolates the brush shaft and motor shaft from the handle, meaning that there is no direct connection between the handle and those parts meant to vibrate. If the O-rings 50 are flexible and

resilient, motor shaft 28 can move to some extent both in a vibrating manner (radially, circularly, or any other type of movement caused by drive motor 24), and/or in somewhat of an axial manner with respect to handle 4.

The purpose of isolation joint structure 18 is to reduce, modify, minimize, or attenuate the amount of vibration felt in handle 4 when motor 24 is vibrating in brush shaft 12 (or elsewhere) and causing bristles 16 to move. Isolation joint 18 between motor shaft 28 and handle 4 can include several different vibration dampening and elimination structures. Any type of isolation joint 18 that accomplishes this is contemplated by this invention, and could include a single or multiple cylindrical bushings 70 spacing brush shaft 12 from handle housing 4, such as that shown in Figs. 14 and 15.

In Fig. 14, brush shaft 12 is inserted in and retained in recess 22 of housing 4 by bushing 70 to form an isolation joint 18. It is contemplated that the bushing will be constructed of a vibration dampening material to absorb the vibration from the vibration means 24 contained in the brush head 14 or brush shaft 12. The embodiment of Fig. 14 will allow the brush shaft 12 and brush head 14 to vibrate relatively independently of the handle.

In another embodiment in Fig. 15, handle 4 is inserted in and retained within brush shaft 12 by bushing 70 to form an isolation joint 18. Similar to the embodiment illustrated in Fig. 14, the bushing 70 is included to absorb the vibration from the vibration means 24 contained in the brush head 14 or brush shaft 12. Also, the vibration dampening bushing 70 will allow the brush shaft 12 and brush head 14 to vibrate relatively independently of the handle 4. Although the circumference of the handle illustrated in Fig. 15 is substantially smaller than that of the brush shaft, it is contemplated that the circumference of the handle 4 will expand along the length of the handle away from the bushing 70.

In another embodiment illustrated in Fig. 16, isolation joint 18 could be a flexible section 72 positioned in brush head 14 or handle 4 so long as the flexible section 72 is positioned between and structurally isolates motor 24 and handle 4. Flexible section 72 can be made out of rubber, elastomer, or any kind of vibration dampening material suitable for the purpose.

Referring to another embodiment in Fig. 17, the entire brush shaft 12 (and motor shaft 28) could be made of a flexible material with motor 24 mounted therein,

with a section of brush shaft 12 (including motor shaft 28) between motor 24 and handle 4 acting as the isolation joint 18. Flexible brush shaft 12 could be made of any type of elastomer or such material as would allow for flexible vibratory motion as a result of motor 24 (or other type of vibratory drive motor). The entire brush shaft 12 could be flexible or only sections thereof.

Figs. 18-20 show the vibratory means 24 and isolation joint 18 located on various portions of a toothbrush. In Fig. 18, the vibratory means 24 are located in brush head 14 and the isolation joint 18 is located at base 40 of brush head 14. The design in Fig. 18 reduces the vibrations of the vibratory means from transferring to the handle portion of the housing.

In Fig. 18, a brush head 14 may be attached to brush shaft 12 with a snug fit on the top of shaft 12 and into the top 34 of recess 36 of brush head 14. A circumferential snap attachment feature 38 circumferentially locates and axially retains the bottom 40 of brush head 14 to shaft 12.

In Fig. 19, the vibratory means 24 are located in brush shaft 12 and the isolation joint 18 is located in brush shaft 12. The location of the vibratory means 24 in the embodiment illustrated in Fig. 19 would affect the amount of vibrations translated to both the handle and the bristles. The amount of vibration to the bristles would likely be less than that in the Fig. 18 embodiment and the amount of vibration translated to the handle may be slightly more than that in the Fig. 18 embodiment.

In Fig. 20, the vibratory means 24 are located in brush head 14 and the isolation joint 18 is located in brush shaft 12 towards handle 4. In this embodiment, the vibration will likely be maximized in the brush head and bristles. However, the vibration felt in the handle may be slightly greater than in the embodiment of Fig. 18.

In addition to the embodiments described above, additional embodiments including optional features are contemplated. Examples of such features are discussed in greater detail below.

As particularly illustrated in Fig. 3, the connection leads 23a,b are connected from motor 24 to battery 10 through isolation joint 18. In one embodiment, cylindrical bore 42 is formed through the center 76 of motor shaft 28 thus allowing the leads 74 to pass therethrough to motor 24. In any of the other embodiments described herein, the passage of the leads 74 therethrough would be equally simple.

In any of the above isolation joint structures 18, or any other contemplated by this invention, the portion of toothbrush 2 which includes motor 24 (i.e., motor shaft 28 / brush shaft 12) can move with respect to the other portion of toothbrush 2 from which it is isolated. The movement of the motor-including portion can be in a twisting manner, a vibrating manner, an orbital manner, a rotational manner, or any other type of motion helpful for cleaning teeth.

In one embodiment, the vibratory means 24 is positioned as close to brush head 14 as possible. Such positioning helps, even without an isolation joint 18 between vibratory means 24 and handle 4, to more efficiently drive brush head 14 and only residually drive handle 4. In this example, isolation joint 18 increases the effectiveness of positioning vibratory means 24 near or in brush head 14. When the placement of vibratory means is as close to brush head 14 as possible, the location of isolation joint 18 need only be on the handle 4 side of the vibratory means placement. In other words, isolation joint 18 may be located between vibratory means and handle 4. Thus, isolation joint 18 could be closer to brush head 14 than to handle 4, in one embodiment.

The end cap may also include an on/off switch for actuating the device. Figs. 21-23 show a combination switch and battery holder end cap 92 used in one embodiment. The end cap combination 92 provides a sealed assembly, and includes two electrically non-conductive parts 122 and 124. Part 124 may be secured into an interior portion of handle 132 at its end.

Electrically conductive parts 126 and top battery contact 130 are assembled into housing 124 which may be fixed in handle 132. Battery carrier 122 holds lower contact strip 128 axially, but not rotationally fixed, into housing 132. The limits of rotation of housing 132/battery carrier 122 assembly are fixed by a radially protruding rib 140 that is received by a corresponding groove in housing 132. Similarly an axially protruding bump 144 formed on a flexible portion of battery carrier 122 is received by either of two corresponding grooves in housing 132. Each of these grooves the rotational assembly (of 122 and 132) in one of two operating positions. Bump 144 and the flexible portion of the area surrounding bump 144 allows the assembly to "snap" from one operating position to the second operating position providing a positive tactile click as battery carrier 122 is rotated. When this occurs the top contact 126 is brought into physical and electrical contact with the bottom

contact strip 128 which is in direct communication with a bottom (-) terminal of a battery. This action causes a complete electrical path from a top (+) terminal of a battery to top contact 130 through motor wires 74 back through contact strips 126, 128 causing motor 24 to operate.

A positive seal is achieved with O-ring 156 sealing between housing 132 and the inside diameter of housing 132 which provides a drip proof feature that prevents moisture from running down handle 132 and accumulating or running into the internal cavity of the device.

Fig. 24 shows an embodiment of a motor shaft cap 96, shown in Figs. 4 and 12. Motor shaft cap 96 is a plug for the open top end 46 of motor shaft 28 to encase the motor within the cavity 48 of the motor shaft 28. In the embodiment illustrated in Fig. 24, cap 96 includes a plug portion 97 and an end cap 6 portion 99. Plug portion 97 extends into open end 46 of motor shaft 28. Portion 99 is of a larger diameter than plug portion 97, and cap 96 forms a fluid resistant seal to prevent fluids from entering into cavity 48.

Figs. 25-26 show a brush head cover 98 that snaps onto and off of brush shaft 12 to cover brush head 14. A front face 100 of brush head cover 98 defines a plurality of holes 102 to allow air exposure and drainage of any moisture trapped on brush head 14 when brush head cover 98 is put on. Brush head cover 98 has a main body 104 that encloses bristles 16 when positioned on brush head 14 and has an attachment structure 106 which defines a partially cylindrical collar 108 attached to rear 110 of main body 104. This partially cylindrical collar 108 has sloped walls 112 to allow brush head 14 of toothbrush 2 to be initially placed into main body 104 and then collar 108 snapped around the perimeter of brush shaft 12 to secure cover 98 onto brush shaft 12 in a releasable manner. The sidewalls 114 of collar 98 are biased outwardly and around brush shaft 12 to provide a secure attachment.

As shown in Fig. 27, at least one flossing element, as opposed to a set of bristles for use as a toothbrush, can be attached to the brush shaft or motor shaft for use in cleaning the interproximal spaces between a user's teeth.

All directional references used herein (e.g., upper, lower, upward, downward, left, right, leftward, rightward, top, bottom, above, below, vertical, horizontal, clockwise, and counterclockwise, etc.) are only used for identification purposes to aid

the reader's understanding of the present invention, and do not create limitations, particularly as to the position, orientation, or use of the invention.

Although embodiments of the present invention have been described with a certain degree of particularity, it is understood that the present disclosure has been made by way of example, and changes in detail or structure may be made without departing from the spirit of the invention as defined in the appended claims.